DOCUMENT RESUME

ED 439 668 IR 019 937

AUTHOR	Kelch, Panette Evers; Karr-Kidwell, PJ
TITLE	How Computer Technology Expands Educational Options: A Rationale, Recommendations, and a Pamphlet for Administrators.
PUB DATE	2000-01-24
NOTE	68p.; Colored text and images in the appendix may not reproduce adequately.
PUB TYPE	Opinion Papers (120)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Computer Uses in Education; Educational Administration; Educational Development; *Educational Resources; *Educational Technology; Elementary Secondary Education; Instructional Materials; *Internet; World Wide Web

ABSTRACT

The purpose of this paper is to provide a historical rationale on how computer technology, particularly the Internet, expands educational options for administrators and teachers. A review of the literature includes a brief history of computer technology and its growing use, and a discussion of computer technology for distance learning, for research writing, and for assisting teachers with instructional materials, lesson plans, maintaining grades, and accommodating different student-learning styles. Discussion then moves to implementation of Web-based teaching, using online formats versus in-class formats, and the benefits and limitations of the Internet for education. The paper concludes that it is the responsibility of administrators to work with teachers and students to develop appropriate applications and guidelines for effective Internet use in schools. Included with the paper is a pamphlet for teachers and administrators that lists Web sites for all subject disciplines that teachers can use for incorporating Internet resources into the classroom. (Contains 52 references.) (AEF)

HOW COMPUTER TECHNOLOGY EXPANDS EDUCATIONAL OPTIONS: A RATIONALE, RECOMMENDATIONS, AND A PAMPHLET FOR ADMINISTRATORS

Panette Evers Kelch
Huntsville I.S.D./ Educator
Masters Student, TWU

PJ Karr-Kidwell, Ph.D.
Professor, Educational Leadership
Texas Woman's University

INTRODUCTION

Computer technology is changing society as nothing else has changed it before (Desey, 1997; Galbreath, 1997). Clearly, the computer is one of the most volatile communication marvels of the century. Computers, connected to the wider world through the Internet, are a primary key to the economic survival of small towns and rural areas throughout the United States. Computers are providing local, necessary jobs so people in society do not have to send the best and brightest children away to the cities as migrant workers, looking for opportunities equal to their abilities (Mussehl, 1999). Computer technology now is making main street businesses more competitive, giving them access to national and international markets (Galbreath, 1997; Mussehl, 1999).

The Internet presents virtually anyone, nearly anywhere, access to information and ideas as never before in the world's history (Desey, 1997). With the development of the Worldwide Web, preschool children to housewives can reach information that was not readily available (Galbreath, 1997). Today, the Internet is used for a variety of reasons all over the globe--in homes, businesses, and even education. "This electronic invasion will do for education what the printing press did for the world, making information cheaper, faster and better"

(Kaufman, 1998, p. 63).

Many people believe that the Internet is a great research tool, an information superhighway (Kearsley, 1998). Some experts believe that children should be prepared, demanding that schools lead them into this technology with skills for the near future, even if it costs more in the short term (Mussehl, 1999). Individuals in society must also be educated to these new realities of technology, since computers open up the world to students and educators.

Yet other experts believe that the Internet is filled with incorrect information and this information may fluster the student and teacher (Stroh, 1998). With the arrival of instructional technology, it is necessary to determine whether the Internet is actually a more effective teaching tool than traditional teacher-centered instruction. It is important to know if students retain more information from a lecture, from a video or from the Internet (Trenton, 1997). The question becomes whether or not the Internet is really the right path to increasing learning or a dead end.

Statement of Purpose

The purpose of this paper was to provide a historical rationale on how computer technology expands educational options for administrators and teachers. After examining the related literature and providing recommendations,

a pamphlet was designed to enhance the awareness of educators and administrators using the Internet for information to expand learning.

REVIEW OF RELATED LITERATURE

Valuing the powerful effect of computers on our lives is noteworthy. Never has so much attention been focused on one aspect of technology as people in society are experiencing today with the computer and the Internet. Clearly, it is one of the most explosive communication phenomena of the century. Many experts point to the Internet as becoming the ultimate information superhighway (Davis, 1995; Galbeath, 1997; Kearsley, 1998; Ragothaman & Hoadley, 1997). Examination of its roots and early development, current uses, and where technology is heading in order to understand this phenomena is a necessity.

A Brief History of Computer Technology

The abacus, originating 5,000 years ago in Asia Minor, may be considered the first computer (Pursell, 1998; Weik, 1961). This device allowed users to make computations, using a system of sliding beads arranged on a rack. Early merchants used the abacus to keep trading transactions (Pursell, 1998). The real beginning of today's computers, however, started with an English

mathematics professor, Charles Babbage, in the 1800s (LaMorte, 1998; Lubar, 1983; Pursell, 1998). Pursell (1998) reported that Babbage noticed that machines did tasks repeatedly, without error, while mathematics often required repetition of formulas. The problem was to combine the capability of machines with the needs of mathematics. Babbage worked 10 years to store a program and print results automatically then worked on the first general-purpose computer (Lubar, 1993; Pursell, 1998). Although these computers were ultimately never built, Babbage's ideas outlined the basic elements of the modern computer (LaMorte, 1998; Lubar, 1993; Pursell, 1998).

At the outbreak of World War II, world governments were developing computers for their strategic importance (LaMorte, 1998; Lubar, 1993). This increased funding for computer development projects hastened technical progress. By 1941, German engineer Konrad Zuse developed a computer to design airplanes and missiles (Lubar, 1993). In 1943, the British completed a computer called Colossus to decode German messages (LaMorte, 1998; Lubar, 1993). Lubar (1993) stated that Colossus's influence on the computer industry's evolution was limited for two reasons. First, Colossus was not a general-purpose computer, but only designed to decode secret messages. Second, the computer's existence was kept secret years after the war. By 1944, Harvard engineer Howard Aiken produced an all-electric calculator which created ballistic charts

for the United States Navy (LaMorte, 1998).

In the mid-1940s, John von Newmann introduced a computer which stored both programs and data--a design that remained essential for 40 years (LaMorte, 1998; Weik, 1961). This technique allowed the computer to stop and resume at any point and allowed for greater flexibility in computer programming. In 1951, the Universal Automatic Computer, built by Remington Rand, became one of the first commercially available computers to take advantage of these advances. Both the United States Census Bureau and General Electric owned these computers. Rand's computer was used to predict the winner of the 1952 presidential election in which Dwight D. Eisenhower was anticipated to win (Lubar, 1993).

Growing Use of Computer Technology

The 1960s contained numerous commercially, successful computers used for business, universities and government from companies such as Burroughs, Control Data and IBM (Descy, 1997; Galbreath, 1997; Lubar, 1993). These computers were characterized by the fact that operating instructions were made-to-order for the specific task for which the computer was to be used. Each computer had a different binary-coded program called a machine language that told it how to operate. This made the computer difficult to program and limited

its versatility and speed (LaMorte, 1998). Even with these limitations, by 1965 most large businesses prepared computerized financial statements (Descy, 1997; Galbreath, 1997). The stored program and programming language gave computers the flexibility to be cost effective and productive (Descy, 1997).

Galbreath (1997) wrote that the modern-day computer was a Cold War outcome. The United States Department of Defense created a network for transferring information to military research facilities. In the 1970s, universities, research facilities and European organizations joined the network. In 1981, IBM introduced its personal computer (PC) for use in the home, office and schools. The 1980s included an expansion in computer use in all three areas, as clones of the IBM PC made the personal computer more affordable. The number of personal computers more than doubled from 2 million in 1981 to 5.5 million in 1982. Ten years later, 65 million PCs were being used (Galbreath, 1997; LaMorte, 1998). Computer developments continued their trend toward a smaller size, working down from desktops to laptop computers to palmtops which fit inside a pocket (Galbreath, 1997).

The ban on commercial use was lifted in 1991, and by 1994, today's computer was in full swing (Descy, 1997). Since the computer was created for electric mail and file transfer capabilities (1997), it was not hard to realize its diverse applications.

As computer usage became more widespread in the workplace, new ways to harness their potential developed. As smaller computers became more powerful, they could be linked together or networked to share memory space, software, information and communicate with each other (Descy, 1997; Galbreath, 1997). As opposed to a mainframe computer, which is one powerful computer that shares time with terminals for many applications, networked computers allow individual computers to form electronic co-ops. Using either direct wiring or telephone lines, these networks can reach enormous populations. A global web of computer circuitry links computers worldwide into a single network of information (Descy, 1997).

Today, computers do more than simply compute (LaMorte, 1998). Supermarket scanners calculate our grocery bill, while keeping store inventory. Computerized telephone-switching centers handle millions of calls and keep communication lines open, and the automatic teller machines let us conduct banking transactions worldwide. People can manage their personal finances; organize protest movements; check facts; discuss personal issues; check the scores of their favorite team; go online with the superstars; organize groups to save the rain forest; cast votes; learn more about an illness of a family member; and get video clips from a soon to be released movie (Tapscott, 1999). Using recent engineering advances, computers can accept spoken-word instructions and

imitate human reasoning. The ability to translate a foreign language is one major goal of computer technology. This feat seems a simple objective at first, but appears much more difficult when programmers realize that human understanding relies as much on context and meaning as it does on the simple translation of words (Pursell, 1998). Computers have not only invaded the business world, but also have been introduced into the field of education.

Computer Technology for Distance Learning

In distance education, the Internet plays an important role to the betterment of the student by delivering information in alternative formats so that individuals gain new knowledge and experience that might have been impossible (Powers, 1997). Distance education has four phases: printed correspondence, radio/television broadcasts and satellite telecasts. The fourth phase involves computer communication, associated with on-line databases, electronic mail and computer conferencing (Findley & Findley, 1997; Goodyear, 1993; Powers, 1997; Romiszowski, 1993). Although the computer has been around for some time, the Internet is the first example of practical use for distance learning (Locatis & Weisberg, 1997). One can present an entire course on Internet (Findley & Findley, 1997). The course can be available worldwide with credit given to properly enrolled students.

The technology opportunities for distance education are astounding. Reinhardt (1996) noted common uses in distance education included reaching individuals isolated by distance or geographical barriers; reaching non-traditional populations such as adults and homebound students; providing instruction in specialized subject areas such as advanced physics or foreign languages; bringing experts into the classroom; connecting two classrooms together so that students can interact; and allowing teachers to consult with experts remotely. Advances in computer technology have allowed widely separated groups to communicate quickly and easily through electronic mail and the Internet as well as allowing instructors to hold simultaneous or long-term discussions (Powers, 1997). Computers allow learners to ask instructors questions and receive answers promptly and conveniently. Certainly, this concept in distance education is exciting, and hardware and software innovations are making computers more available, easier to use, and less costly (Locatis & Weisberg, 1997; Simonson, 1997).

The distance learning experiences enrich lives by delivering information in alternative formats which help students gain new knowledge and experience (Powers, 1997). Interactive learning commands exceptional teaching and learning. Excellent teachers know that by involving students in this hands-on learning students will grow from the experience. Traditional distance learning

also requires commitment and interest from a successful learner (Epps, 1998; Powers, 1997). A videotaped lesson rarely incorporates a voice of encouragement at the right time, a smile, or pat on the back, nor can this correspondence course call one by name (Powers, 1997). When a distance learner uses the Internet, the student feels part of a true learning environment. Kearsley (1998) reported that the Internet lessens discrimination and prejudice that arises naturally in face-to-face meetings. Unless someone deliberately reveals such attributes, one has no idea about the age, gender, ethnic background, physical characteristics or disabilities of students. Computers are color-blind. Through technology, one can find the anonymity to work freely without discrimination that lurks in society today (Kearsley, 1998; Mussehl, 1999).

Computer Technology for Research Writing

Computer technology is not only helpful in distance learning, but also research writing. Internet research papers frequently involve students in gathering information on assigned or selected topics. Information is gathered in two primary ways, namely communication and online research. Contacting experts online to gather information is essential in obtaining solid, valid facts or opinions (Balabanian, 1994). The issue of authenticity and establishing a real

world context for students is frequently linked to affective outcomes like motivation and interest, and the Internet research writing projects follow suit (Oliver, 1997). Students are clearly motivated and express excitement through using the Internet. They work with information that is current. Students appreciate the chance to become producers of knowledge (Oliver, 1997).

One interesting outcome of using the Internet for writing research papers is that teachers find students have a willingness to work on projects at home and after school hours, which is certainly not common when using only library and traditional research sources. Only vocabulary and organizational skills do not improve with Internet use, but these skills do not decrease in the research process (Davis, 1995).

"Teaching students to use the latest in computer-based communication technology is a paramount importance in this globally networked educational community" (St. Clair, 1997, p. 11). Internet research for writing papers teaches students to value management and communication research, to make informed decisions, to analyze and adapt to a given audience, and to gather and analyze data from sources with multiple points of view. Teaching students to use the Internet as a research tool encourages them to become lifelong learners and to develop and sharpen skills in conducting research as part of their regular work, not as a "one-time" project requirement (St. Clair, 1997).

As more schools add computer capabilities, the Internet is becoming an increasingly valuable part of the composition course study. The Internet can help students do research, learn and understand different perspectives on a given topic, and open their eyes to the potential of communication technology (Lewis, 1998). The most obvious and typical use of the Internet in composition is a research tool for the documented paper. News groups and the World Wide Web can provide sources and personal contacts for writing papers (Bergland, 1996). On-line writing labs provide hundreds of handouts about all aspects of writing. Although teaching the technology will take time away from other writing instruction, research students can clearly benefit from using the Internet for their assignments. Bauman (1998) reveals that "good writing combines fresh ideas energized by vivid details" (p. 26). These ideas can readily be found on the Internet.

The Internet provides additional sources for reference materials for student research in the same way it does for teachers. Children can benefit from the problem-solving skills needed to locate appropriate resources, as well as from the increased amount, kind, and complexity of materials available at the content sites (Lewis, 1998). Students gathering information about cities, states, and countries around the world can use the World Wide Web browser-search function to find sites that help them learn more about how people live in other

locations they have yet to visit. Sites targeting special populations, such as Latin World, can save considerable research time. These sites often provide land-mail and e-mail addresses for more information. An advantage of the activities provided by many of the Web sites is that students can work through them at their own speed, allowing for individual differences (Lewis, 1998).

Researching information for class projects can be designed to allow learners to fit the instruction into their schedules when it is convenient. They are not locked into a fixed period of time. Students and teachers can "surf the net" for their research needs and still meet their regular responsibilities (Lewis, 1998). "Internet surfing has an intrinsic educational impact in that the user must acquire and use skills to retrieve and select information. This aspect should not be underrated, especially where permanent training and lifelong learning are concerned" (Trentin, 1997, p. 23).

The role of research writing, when using the Internet, is crucial since the range and quality of the computer experience potentially influences later attitudes towards computers. The immense educational potential of the Internet also means that all students need to be in a position to benefit fully, even if computers are unlikely to play a central role in future careers (Cassidy, 1997).

Computer Technology for Teachers

Distance learning and research writing are only two of the many ways computers can assist the educator. Ragothaman and Hoadley (1997) depicted that the computer can generate tests, worksheets and letters. It can assist teachers in writing lesson plans and maintaining students' grades. Teachers can also accommodate the different student learning styles. The top three ways teachers use the Internet are to do research, to access curriculum materials, and for lesson planning (Lewis, 1998). The computer is motivating and provides positive feedback and encouragement. There are endless uses for the Internet in the classroom for instructors, as well as studnets (Lewis, 1998; Ragothaman & Hoadley, 1997).

Instructors can use the Internet to access curriculum materials. For example, accounting and finance resources which can be used as supplemental reading materials are available on Internet (Benyon, Stone, & Woodroffe, 1997). Professors can also use Internet tools and resources to redesign a course completely and reduce paper (Maly, 1996). Students can e-mail fellow students and teachers (Nkambou & Gauthier, 1996). In a situation where responses to questions can be posted on the Internet, even the most shy student can participate in the discussion.

The Internet is a useful tool for gathering background information when developing instructional units in most content areas (Lewis, 1998). For example, the knowledge base in the sciences is expanding rapidly. The Web can bring some of the frontiers into the classroom. Together, the teacher and the student can learn about the exploration of Mars and the edges of space from the NASA and Hubble Telescope sites. With a site named Netfrog, students can learn what to expect when dissecting a frog before actually cutting open a frog. The pictures are not high quality, but the site provides useful detail (Lewis, 1998). Resources on the Web can extend those in nearby libraries, and are especially useful in rural areas where community resources are limited. In addition, the teacher can print pictures from the Internet and use them when creating bulletin boards. Artwork from the masters and contemporary artists are available on the Web for teacher use. Teachers can also display student work to the world by publishing it on a Web page. Some Web sites even provide opportunities for student publication (Hope, 1997; Lewis, 1998).

Sources for professional development also can be located on the Web. For example, the National Association for Gifted Children and the Association for the Gifted are two national organizations with memberships composed of educators, other professionals, parents, and community leaders committed to meeting the unique needs of children and youth who are gifted and talented

(Lewis, 1998). Addresses for state gifted organizations can be located under the heading "Organizations and Societies" in The Gifted Home Page. These organizations provide support and services for many teachers. Current research-based information, in the form of publications and videos, is available from the National Research Center on the Gifted and Talented. This center is federally funded to conduct and disseminate quality research, particularly in the area of identification of traditionally undeserved populations. This is an excellent source of documents on current issues in gifted education (Lewis, 1998). There are Web sites for all educational disciplines which can be examined, when and where the educator needs.

Learning and teaching through the Internet is much different from a traditional classroom experience, even when used as part of a conventional classroom. People who have poor writing skills may be at a disadvantage in an Internet environment, since written communication is also a significant skill (Bakken & Aloia, 1998). On the other hand, having to write everything gives people a chance to think about their responses, since one does not need to respond immediately. The Internet requires plenty of practice in writing which often results in improved communication skills. For some learners, this result is just as important as the subject matter they are trying to learn (Bakken & Aloia, 1998).

Tapscott (1999) reported that with new technologies, education professionals will experience a shift away from traditional types of teaching to the creation of learning partnerships and learning cultures. This is not to say that teachers should not plan activities or design curriculums. They might, however, design the curriculum in partnership with learners, or even help learners design the curriculum.

This constructivist approach to teaching and learning means that rather than assimilate knowledge that is delivered by an instructor, the learner constructs knowledge anew. Constructivists argue that people learn best by doing rather than simply listening. The evidence supporting constructivism is persuasive, but that should not be too surprising (Reinhardt, 1996; Tapscott, 1999). When children are enthusiastic about a fact or a concept that they discovered, they will retain the information better and use it in creative, meaningful ways (Tapscott, 1999).

The new focus of the learning experience is on the individual rather than on the instructor. Learner-centered education improves the child's motivation to learn (Tapscott, 1999). The shift from teacher-centered to learner-centered does not suggest that the teacher is suddenly playing a less important role. A teacher is equally crucial and valuable in the learner-centered classroom, for he or she creates and structures what happens there. Learner-centered education begins

with an evaluation of abilities, learning styles, social contexts and other important factors that affect the student (de Pommereau, 1997; Tapscott, 1999). Evaluation software programs can tailor the learning experience for each individual child. Learner-centered education is also more active, with students discussing, debating, researching, and collaborating on projects with one another and with the teacher (de Pommereau, 1997).

These new computer technologies have helped create an enrichment for learning in which the learner enjoys reinforced interactivity and connections with others (Cassidy, 1997; de Pommereau, 1997; Hope, 1997; Tapscott, 1999). Rather than listen to a teacher regurgitate facts and theories, students discuss ideas and learn from one another, with the teacher acting as a participant in the learning. Students construct reports that make sense out of their own experiences (de Pommereau, 1997; Kaufman, 1998; Tapscott, 1999).

While students and teachers may freely seek information and knowledge, using the Internet sensibly and profitably means learning how to locate the most appropriate information sources, deciding whether they are reliable or not and putting the information gained to good use. Users who lack these skills are wasting a good deal of time and energy for little return (St. Clair, 1997). If the Internet is to be effective for learning, teaching students how to search for information efficiently and evaluate the quality is paramount. Davis (1995)

pointed out that just because information is printed does not mean it is valid. A web writer does not need to meet requirements, but can just create a web site and present the material. Therefore, teachers and students must read material critically. Most students have used information from books and other library sources (Oliver, 1997). They know how to use a table of contents to locate relevant information. The Internet may possess a challenge for some students in finding information needed for a certain topic, and not knowing the key search word can be a detriment when using the World Wide Web (Oliver, 1997). Thus, Internet instructional use is being closely observed with favorable results (Kumari, 1999; Lewis, 1998; Oliver, 1997; Powers, 1997).

Implementing Web-Based Teaching

Datla Kumari (1999) cited that the evolution of the Internet as a well established, accessible technology has profoundly impacted the method of instructional delivery at institutions of higher education. Some faculty members are using the web to instruct their students entirely online without the traditional face-to-face interactions, while other professors are using the Internet to supplement traditional instruction. Emerging literature indicates that the following two dimensions of interactions are evolving as factors to success in the virtual classroom: teacher-to-student and student-to-student (Kumari, 1999).

Research indicates that teacher-to-student interactions are different in a virtual classroom in terms of quantity and quality. Such a situation places a different set of expectations upon the faculty and requires rethinking of time constraints, extent of technical expertise, traditional teaching and communication skills (Kumari, 1999; LaBuda, 1999). Like teacher-to-student associations, student-to-student interactions are evolving as indicators critical for successful implementations of online learning. These interactions require that faculty plan and structure progressive learning experiences for students, while ensuring and achieving constancy in student participation. Such conditions foster an atmosphere that encourages collaborative and reflective learning, enriched by various views and stimulated by peer analysis (Kumari, 1999).

Computers mean different things to different users and classroom content varies. Corliss Kaiser of Syracuse University studied three primary teachers during the installation of networked computers in their classrooms. He was interested in how the teachers learned to use computers, how they came to know the role that the computer played in their teaching, and what they believed helped or hindered their quest. The case study was conducted over a period of one year. The study concluded that each teacher used computers in different ways based on their established routines, educational philosophies, and histories. Many barriers to their practice were uncovered. There seems to be challenges

associated with implementation of Internet use with students, even after teachers have developed skills and favorable attitudes toward Internet use. These challenges include curriculum integration-resources, and time for teachers to develop and carry out Internet-based activities (Kaiser, 1998). Time and expertise seem to be the primary factors when implementing the Internet in classrooms.

Online Format Versus In-Class Format

The past five years have born witness to a revolution in education, with acceleration in the use of online technologies to assist traditional methods of instruction. As more online courses and programs grow, the questions of quality and comparability of such instruction with traditional methods naturally arise. Gubernick and Ebeling (1997) reported on a study conducted by researchers at the University of Phoenix that demonstrated standardized achievement test scores of its online graduates were 5% to 10% higher than graduates of competing on on-campus programs at 3 Arizona public universities. One hundred-eighty students were enrolled in online courses for the majority of their college studies. The online students' test scores were compared to the average scores of the on-campus students. While one may legitimately question the degree of comparability of the subject populations, these results are similar to

those summarized by Vasarhelyi and Graham (1997) where the investigators at the University of Michigan concluded that computer-based instruction yielded higher average scores than traditional instruction.

To date, the most methodologically sound investigation to evaluate the effectiveness of online instruction was conducted by Gerald Schutte at Cal State, Northridge (McCollum, 1997). Schutte randomly divided his statistics class into two groups of equal, previous academic performances. One class attended class as usual, listening to lectures, handing in homework assignments and taking examinations. The other class took an online version of the course, completing assignments on a World Wide Web site, posting questions and comments to an electronic discussion list, and meeting their professor in an Internet chat room. After an orientation session, students in the virtual class went to Dr. Schutte's classroom only for their mid-term and final exams. On both tests, the wired students outscored their traditional counterparts by an average of 20%.

Allan Schulman and Randi Sims (1999) did not confirm Dr. Schutte's study. Students enrolled in 5 different undergraduate online courses during the Fall semester participated in a test-retest study designed to measure their learning of the course material. These students were compared with students enrolled in traditional in-class courses taught by the same instructors. In total, 40 undergraduate students were enrolled in the online course and 59

undergraduate students were enrolled in the in-class courses during the testing period. All students were given pretests and posttests to measure the students' knowledge before and after taking the course. The results indicated that there were no significant differences for the posttest scores for the online and in-class students. The study demonstrated that the learning of online students was equal to the learning of in-class students.

Another study by Mary Stephen (1997) at Saint Louis University proposed to explore the differences in teachers' and students' experiences with computers, perceptions of computers and the effects of these differences within the social and cultural context of a computer-supported classroom. Data collection focused on a teachers' experiences with computers, students' experiences with computers, teachers' perceptions of computers, students' perceptions of computers, nature of computer-supported classroom activities, teacher's understandings of the purpose of the computer-supported activities, and student's understandings of the purpose of computer-supported activities.

This study involved one class of fourth grade students, the classroom teacher and the computer lab teacher in an urban, technology-advanced school. Findings of this study suggested an unevenness in the degree of importance the effects of experiences with computers and perception of computers assumed among teachers and students in computer-supported activities. The study

suggested that while a teacher's perception of computers plays a role in the use of computer technology in classroom activities, the teacher's style of adopting this technology into his or her teaching and the teacher's view of students' competence using computers more strongly influence the teacher's design and implementation of such activities. In contrast, the findings of the study suggest that a child's experiences with and perception of computers play an important role in the child's level of confidence using computers, and without the teacher's help, affected the child's understanding of computer-supported classroom activities (Stephen, 1997). The child's needs, however, must be met for complete success.

Benefits and Limitations of the Internet

The Internet's educational advantages, like its practical ones, depend on how its affordability matches users' needs. The Internet's primary advantage is that it lets people both access information and communicate online. Since information and individuals are accessible, knowledge can be tapped for learning from libraries and databases, from individuals and expert systems. The Internet's second advantage is that it allows for both centralized and decentralized information flow. Its range of affordances is so broad, the question is not how they might be used best to achieve different learning outcomes, but which

learning outcomes deserve their support (Locatis & Weisberg, 1997). To understand the benefits, it is important to investigate how teaching strategies have changed with the introduction of the Internet.

Reinhardt (1995) distinguishes old and new educational models. The old is characterized as being teacher-centered with omniscient classroom instructors and passive learners working individually to acquire uniform content. In contrast, the new model is learner-centered with individual exploration, active apprenticeship and teachers guiding teams of learners in acquiring diverse and rapidly changing content. In addition, the older paradigm emphasizes learning knowledge in the abstract versus learning in context, learning basic skills versus learning problem-solving strategies, and developing positive attitudes toward specific subject matter versus developing lifelong learning skills. The Internet is more suitable than competing technologies for implementing the newer paradigm outcomes because of its time and place of instruction, the individualization of instruction, and the kinds of interactions users can have (Reinhardt, 1995).

More than 9 out of 10 teachers in the United States believe that using the Internet in the classroom is an excellent idea and, more than half of those teachers polled believe students should start learning how to use the Internet before the fourth grade (Cassidy, 1997). Few teachers, however, consider

themselves expert at Internet use, even though they see significant benefits from its use (Cassidy, 1997; Lewis, 1998). Students can access hard to find information and resources. The Internet can also increase students' familiarity with information technology (Bakken & Aloia, 1998; Lewis, 1998). Both teachers and students can obtain information on current events in order to update their textbooks (Cassidy, 1997). Teachers have the ability to talk with other teachers and share curriculum, ideas, and teaching methods through e-mail. Teachers can download worksheets and activities for students. These benefits of the Internet are endless when used with the students' benefit in mind (Cassidy, 1997; Galbreath, 1997).

The Internet prepares students to become active learners. By giving students access to and training in the Internet, they are empowered to become participants in their education (Doyle, 1999). Students can be directed to view video, text, and animation on the Internet at their own pace, in an interactive manner that allows repeated viewing and that accommodates a student's personal style for absorbing information (Doyle, 1999; Mussehl, 1999). If students must demonstrate understanding of difficult content, such as the phases of the moon, animation provides a powerful tool for illustrating what is difficult to convey with words or statistics. For example, as part of an assignment on geometric polyhedra, a teacher can direct students to linked web sites to obtain an

overview of the subject. Children benefit more from their learning when they are active participants (Doyle, 1999).

A world of resources is as close as the keyboard, but the computer to which it is attached is still an expensive educational tool (St. Clair, 1997). If there is a less expensive or easier way to teach a skill, then a computer and the Internet are unnecessary frills that may even interfere with the instructional process, if they take on more importance than the content they were intended to deliver. Furthermore, Internet access does not take the place of direct interaction with people, places, and things (Powers, 1997; St. Clair, 1997). Virtual concerts, galleries, and museums are only substitutes for the real experiences, although they do extend the student's reach beyond the immediate community (St. Clair, 1997).

The great advantages of these capabilities seem to outweigh the disadvantages which include the difficulty of maintaining teachers' competence in their fields, the impossibility of deciding issues of department size and variety, questions regarding the effectiveness of learning that does not take place face-to-face and problems of students' and teachers' time management. All these factors are what the traditional teaching methods presently include (Lewis, 1998).

At least three problems arise in an effort to infuse technology into

schools and teachers' practices (Hope, 1998). One is the difficulty associated with obtaining hardware. The cost to equip a school with computers and related technologies is enormous. It is rare that a school will have, at one time, all the money needed to purchase the technologies desired to meet specified objectives (Hope, 1998; Reinhardt, 1996). The second problem is maintaining hardware that has been purchased. Once the decision to obtain specific technology is acted upon, provisions for maintenance must be initiated. This aspect of technology entails considerable cost to a school. Both problems are associated with the technology and can be understood in terms of having or lacking financial resources. The third problem resides with the influences that effect teachers' decisions about integrating technology into practice (Hope, 1998). This problem concerning the integration of technology is difficult to reconcile. The lack of interest in integrating technology into the classroom is affirmed in the teachers' fear of technology, lack of interest in technology, reluctance to change because of familiar methods, and unwillingness to replace established classroom procedures and routines (Hope, 1998; Reinhardt, 1996). Of the problems related in infusing technology in schools, overcoming those stemming from human nature are imperative, if teachers are to integrate technology into their classrooms (Reinhardt, 1996). Without humans, technology cannot be used to its potential, but humans can continue to work without technology. Teachers are

not blind to the fact that teaching and learning can proceed with computers and the Internet (Hope, 1998; Reinhardt, 1996). Even though there is support for teachers to use technology, there is no requirement for them to do so (Hope, 1998).

Though the Internet has limitations, its classroom use is growing. Due to its varied applications, classroom access is expected to climb from 1.5 million in 1996 to more than 20 million by 2002 (Cravatta, 1997). By 2002, the number of online households in the United States is expected to grow from 15 to 45 million. The computer will begin to replace the television for entertainment and learning purposes (Cravatta, 1997). Teenagers feel that being online is as "in" as dating and partying. This exploding popularity is occurring while the Internet is still in its infancy and is painfully slow, limited in capabilities, lacking complete security, and subject to ridicule. Nevertheless, children and teens love it and keep coming back after each frustrating experience. They know the potential (Tapscott, 1999). The potential is not limited to the learners, but goes beyond the learning experience to the instruction of that learning (Cravatta, 1997).

Multimedia, for example, enables the design of better instruction (Lookatch, 1997). For the past thirty years, film and video have brought the world into the classroom. Unfortunately, their use brought the community into the classroom rather that the class into the community (Lookatch, 1997).

Multimedia provides the opportunity to interact with the images behind a glass screen. The looming danger is that it replaces interaction with each other and the environment (Bakken & Aloia, 1998; Chodorow, 1995; Lookatch, 1997). Multimedia and other technologies are simply tools that assist with instruction (Chodorow, 1995). Lookatch (1997) stated that, "computer technology has no more influence on achievement and wholeness than a scalpel has on healing" (p. 113).

The ultimate, interactive learning environment is the Internet (Tapscott, 1999). Increasingly, this technology includes a vast wealth of human knowledge, the tools to manage this knowledge, access to people, and a growing world of services ranging from sandbox layouts for preschoolers to virtual laboratories for medical students studying brain surgery. Today's baby will learn tomorrow about Michelangelo by walking through the Sistine Chapel, watching Michelangelo paint, and perhaps stopping for a conversation. Students will stroll on the moon. Petroleum engineers will invade the earth with a drill bit. Physicians will navigate the central nervous system. Researchers will browse through a library. Auto designers will sit in the back seat of the auto they are designing to see how it feels and to examine the outside view. The World Wide Web can provide all of these endless personal experiences (Tapscott, 1999).

Despite the fundamental adjustments that will be necessary, the electronic

revolution in education is a necessary consequence of what is already taking place in research, where multimedia packages and the Internet are being used extensively (Benyon, Stone, & Woodroffe, 1997; Chodorow, 1995). In educational institutions, teaching and learning arise directly from research. Just as scholars and scientists have embraced this revolution, educators should embrace it in their education programs and practices (Chodorow, 1995).

On September 30, 1999, news anchor Peter Jennings reported on a nationwide study which verified the status of computer technology in American schools. Mr. Jennings stated that in the 1980s, approximately 30% of school budgets was spent on computer usage, but by the 1990s, approximately 80% was spent on computer technology. The report also highlighted that only $6.00 per teacher is expended for computer training which is an incredible mismatch of funds, particularly if computers are to be an asset in the classroom. The results of the study supported that increasing computer usage and monies did not raise test scores. Students are not necessarily attaining critical thinking or problem-solving skills while searching the Internet (P.J. Karr-Kidwell, personal communication, November 9, 1999).

Technology does not replace the need for all students to learn and master basic or higher level skills. The use of technology must build on these skills and understandings. Technology is not a substitute for them (Thomas & Sullivan,

1998). The focus must be on learning with technology, not on simply learning technology. In a 1997 report, a presidential panel on educational technology wrote that computer-related skills will be important in the twenty-first century, and while such skills are clearly best taught through the actual use of computers, it is important that technology be integrated throughout the K-12 curriculum, and not simply used to impart technology-related knowledge and skills (Thomas & Sullivan, 1998). If used correctly, technology can lead to more advanced knowledge than previously possible. In planning the curriculum, the appropriate question to ask is whether or not there are critical concepts, understanding and problem-solving skills that cannot be fully taught and learned without the use of technology. The challenge to educators is to identify those concepts, and then, to integrate technology fully into the curriculum so that it effectively supports the mastery of essential skills (Thomas & Sullivan, 1998).

As a predominately middle-aged, female population, teachers have been charged with a "technophobic" resistance to computers in the classroom (Weinman & Haag, 1999). In many cases, however, teachers lack even the most basic training with computer technology and education. In 1997, researchers found that only 15% of teacher candidates nationwide had received at least 9 hours of technology training. Further, the potential advantages of technology in the classroom to promote learning are not entirely apparent to educators.

Teacher training tends to take the form of an introduction to the mechanics of the equipment, rather than how to use it to do teaching jobs more effectively. There is seldom incentive to devote the energy needed to use technologies innovatively (Weinman & Haag, 1999). Teachers need this kind of training to create classrooms that allow students to achieve their full potential.

As the world changes, so does the makeup of our schools. Day by day, our schools become more diverse (Thomas & Sullivan, 1998). Educators will fail to achieve their goal of diversifying schools and culture, if they are not able to manage the rapidly changing world of technology and produce constructive educational outcomes. The goal is to maximize the benefits and minimize the costs as educators prepare their students for the future (Lewis, 1998).

Administrators and teachers must be ready to meet these needs of 21st century classrooms (Cassidy, 1997). Computer technology and Internet websites can expand these educational options. The Internet is like the dawning of a new day. With the new day come challenge and opportunity. "Awaken, then, to discover the power, convenience, efficiency and professionalism that can be yours at the touch of a button" (Hope, 1997, p. 109).

Given this extensive review of related literature and the technological opportunities confronting teachers, administrators, and students, several recommendations are needed to aid in the discovery of important information

that will benefit all personnel and students. Administrators need the basic knowledge of how to aid teachers in their endeavors to promote computer technology in the classroom. When administrators lead teachers in the right direction, the Internet superhighway is an easier path to follow.

Teachers and students need resources to expand their knowledge and go beyond traditional classrooms. Students learn when they are motivated and allowed to be creative. With the aid of a teacher-Internet pamphlet as a resource, educators will have at their finger tips, resources to extend the curriculum to new heights (See Appendix).

CONCLUSIONS

The Internet is new to most people. It is exciting and contains something for everyone. Unfortunately, it is unlike anything that most people have come in contact with in their lives. The Internet is still not designed for the general public, and does not operate by the rules that most users expect. In order to make the most constructive use of the Internet and to prepare current and future generations for this important information source, it is critical that administrators, teachers, and students be made aware of how it operates and what limitations are present at this time.

Administrators, students, and teachers are entering a new world of

information when they search for and use information taken from the Internet. They need to be careful not to take what they see at face value. Administrators, teachers, and students have to be able to look at information and make judgments as to the quality of the material and the reliability of the source. Typically, the emphasis has not been placed on these factors in our educational systems. Students are not usually taught to evaluate the sources of information in the library. They must, however, be taught how to evaluate the sources of information from the Internet.

The Internet is a powerful tool, if used wisely by administrators, teachers, and students, can greatly extend access to world-wide resources and enhance communication across the world. The responsibility of administrators is to work with teachers and students to develop appropriate applications and guidelines. Guidelines make Internet use easier and less stressful for teachers and students. Many software programs eliminate teacher stress concerning students searching on Web sites that are inappropriate for teenagers. Providing current, valid Web sites also saves time for both teachers and students. Administrators also need to stay current with changing technology in order to better serve their staff.

As the world changes, so does the make-up of our schools. Day by day, our schools become more diverse. We will fail to achieve our goal of diversifying our schools and our culture, if we are not able to manage the

rapidly changing world of technology and produce constructive, educational outcomes.

One of the intriguing aspects of online education is that it can sometimes succeed in spite of ineffective instructors. Students can learn by hands-on applications with little guidance from teachers. Teachers need only the basic skills in understanding computer technology and students can grow from that instruction.

There is much talk today about improving our schools across the nation. One of the best ways to improve these schools is for teachers to improve their teaching methods and strategies. A teacher-Internet pamphlet as a resource can improve such methods with little effort from teachers. The research has been done, and the teachers can apply what resources are provided.

The use of computer technology in the classroom has been shown to enhance learning and motivate students. Only teacher instruction is a drawback to implementing computer technology into the classroom. This problem can be met with resources that provide the teacher with web-sites ready for student and teacher use.

Given open-minded consideration of such potential usage, administrators are more apt to see how the Internet can contribute positively to any communication and learning processes in their schools. If new and meaningful

ways to share information with colleagues can be found, teachers can be ready to explore the World Wide Web to enhance students' learning experiences.

REFERENCES

Bakken, J., & Aloia, G. (1998). Evaluating the world wide web. The Council for Exceptional Children, 30(5), 48-53.

Balabanian, N. (1994). Computer networks and equity. Preliminary report of a conference on the use and abuse of computer networks: Ethical, legal and technical aspects, Irvine, CA.

Bauman, M. (1998). Ideas and details: A guide to college writing (Report No. CS-216-000). Orlando, FL: (ERIC Document Reproduction Service No. ED 411 538)

Benyon, D., Stone, D., & Woodroffe, M. (1997). Experience with developing multimedia courseware for the world wide web: The need for better tools and clear pedagogy. International Journal of Human-Computer Studies, 47(1), 197-218.

Bergland, B. (1996). Using the Internet in the introductory composition classroom (Report No. CS-215-396). Paper presented at the annual meeting of the Conference of College Composition and Communication, Milwaukee, WI. (ERIC Document Reproduction Service No. ED 513 234)

Cassidy, M. M. (1997). Using technology in the classroom: An analysis of expectations and outcomes (Doctoral dissertation, New York University, 1996). Dissertation Abstracts International, 57, 4335.

Chodorow, S. (1995). Educators must take the electronic revolution seriously. [Online]. Available: http://www.ucop.edu/ucophome/auc/chdrwabs.html

Cravatta, M. (1997). Online adolescents. [Online]. Available: http://www.demographics.com/publications/as/97_ad/9708_ad/ad970815.htm

Daume, D. (Ed.). (1993). Britannica book of the year. Chicago: Encyclopedia Britannica.

Davis, C. (1995). The I-search paper goes global: Using the internet as a research tool. English Journal, 10, 27-33.

de Pommereau, I. (1997, April 21). Computers give children the key to learning. Christian Science Monitor, 4, pp. 68-71.

Descy, D. (1997). The internet and education: Some lessons on privacy and pitfalls. Educational Technology, 3, 48-52.

Doyle, A. (1999). A practitioner's guide to snaring the net. Educational Leadership, 56(5), 12-15.

Epps, W. D. (1998). Understanding and overcoming barriers to the use of computers in classroom instruction at UCLA (Doctoral dissertation, University of California, 1997). Dissertation Abstracts International, 59, 428.

Findley, B., & Findley, D. (1997). Strategies for effective distance education. Contemporary Education, 68(2), 118-121.

Galbreath, J. (1997). The internet: Past, present, and future. Educational Technology, 6, 39-45.

Goodyear, P. (1993). A synchronous peer interaction in distance education: The evolution of goals, practices and technology Proceedings from the Conference on Advances in Integrated Delivery Technologies, Denver, CO. New York: Routledge.

Gubernick, L., & Ebeling, A. (1997, March 10). I got my degree through E-mail. Forbes, 159, pp. 84-92.

Hope, W. (1997). Today is a good day to begin using a computer. Contemporary Education, 68(2), 108-109.

Hope, W. (1998). The next step: Integrating computers and related technologies into practice. Contemporary Education, 69(3), 137-139.

Kaiser, C. (1998). Searching for purpose: Teachers finding personal meaning for computer usage in elementary classrooms (Doctoral dissertation, Syracuse University, 1998). Dissertation Abstracts International, 60, 1092.

Kaufman, R. (1998). The Internet as the ultimate technology and panacea. Educational Technology, 1, 63-64.

Kearsley, G. (1998). A guide to online education. [Online]. Available: http://www.fcae.nova.edu/~kearsley/online/htm/#nature

Kearsley, G. (1998). Educational technology: A critique. Educational Technology, 3, 47-51.

Kumari, D. (1999). A study of higher education faculty implementing web-based teaching (Doctoral dissertation, University of Houston, 1999). Dissertation Abstracts International, 60, 1092.

LaBuda, H. (1999). Case-based pedagogy versus traditional lecture: A comparison of preservice teachers' knowledge of classroom management principles (Doctoral dissertation, University of Pittsburgh, 1999). Dissertation Abstracts International, 60, 1011.

LaMorte, C. (1998). Computers: History and development. [Online]. Available: http://www.digitalcentury.com/encyclop/update/comp_hd.html

Lewis, J. (1998). How the Internet expands educational options. Teaching Exceptional Children, 30(5), 34-52.

Locatis, C., & Weisberg, M. (1997). Distributed learning and the internet. Contemporary Education, 68(2), 100-103.

Lookatch, R. (1997). Multimedia improves learning--apples, oranges, and the type I error. Contemporary Education, 68(2), 110-113.

Lubar, S. (1993). The Smithsonian book of information-age inventions. New York: Houghton Mifflin.

Maly, K. (1996). Interactive remote instruction: Lessons learned. Journal of Network and Computer Applications, 19(4), 395-404.

McCollum, K. (1997). A professor divides his class in two to test value of online instruction. Chronicle of Higher Education, 43, 23-28.

Mussehl, L. (1999, July 18). Computer country. The Huntsville Item, p. C3.

Nkambou, R., & Gauthier, G. (1996). Integrating www resources in an intelligent tutoring system. Journal of Network and Computer, 19(4), 353-366.

Oliver, K. M. (1997). Getting online with k-12 internet projects. Techtrends, 42, 33-40.

Powers, S. (1997). Three little words: Interactive, distance, and learning. Contemporary Education, 68(2), 92-93.

Pursell, C. (1998). A review of the literature. Organization of American Historians Magazine of History, 12(2), 5-8.

Ragothaman, S., & Hoadley, D. (1997). Integrating the internet and the worldwide web into the business classroom: A synthesis. Journal of Education for Business, 72, 213-216.

Reinhardt, A. (1996). New ways to learn. Contemporary Education, 66(2), 50-72.

Romiszowski, A. (1993). Telecommunications and distance education. Eric Digest, 71, 47-52.

Schulman, A., & Sims, R. (1999). Learning in an online format versus an in-class format: An experimental study. [Online}. Available: hhtp://www.thejournal.com/magazine/vault/A2090.cfm

Simonson, M. (1997). Distance education: Does anyone really want to learn at a distance. Contemporary Education, 68(2), 104-106.

St. Clair, G. (1997). Effectiveness of the website. The Reference Librarian, 58, 10-11.

Stephen, M. L. (1998). A study of the effects of differences among students' and teachers' perceptions of computers and experiences with computers in a computer-supported classroom (Doctoral dissertation, Saint Louis University, 1997). Dissertation Abstracts International, 58, 3098.

Stroh, B. (1998). Intranet before internet--let's talk to our neighbors before perfecting our global conversation. Contemporary Education, 69(2), 103-106.

Tapscott, D. (1999). Educating the net generation. Educational Leadership, 56(5), 7-11.

Thomas, G., & Sullivan, N. (1998). Integrating technology into the curriculum. Leadership, 2, 10-11.

Trentin, G. (1997). Logical communication structures for network-based education and tele-teaching. Educational Technology, 3, 19-25.

Vasarhelyi, M., & Graham L. (1997). Cybersmart: Education and the Internet. Management Accounting, 8, 32-36.

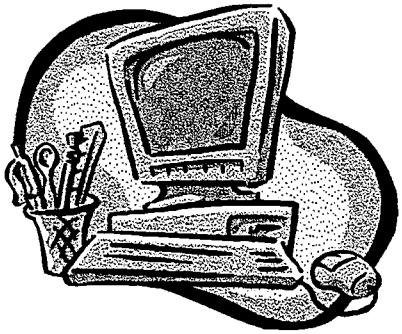
Weik, M. H. (1961). The ENIAC story. [Online]. Available: http://ftp.arl.mil/~mike/comphist/eniac~story.html

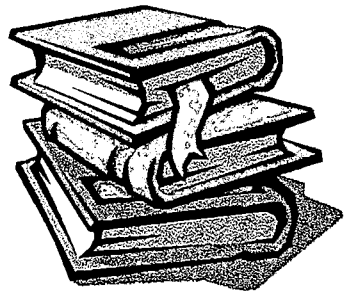
Weinman, J., & Haag, P. (1999). Gender equity in cyberspace. Educational Leadership, 56(5), 44-49.

APPENDIX

USING INFORMATION ON THE INTERNET TO EXPAND LEARNING:

A PAMPHLET FOR ADMINISTRATORS AND TEACHERS





Preface

This paper focused on the need for administrators and teachers to use the Internet in classrooms to motivate students and achieve full learning potential. The following discussions with colleagues at Lake Dallas High School and recommendations demonstrate the need for Internet involvement in all academic disciplines. Administrators and teachers must keep up-to-date on new technology in order for students to be prepared for the 21st century.

Finally, a teacher-Internet pamphlet saves administrators and teachers time and stress in locating reliable Web sites for educational use. Many of the pamphlet's Web sites have links to other sites for further exploration. When the Internet is used in the classroom, administrators, teachers, and students become hands-on learners.

Discussions With Colleagues: Recommendations for Using the Internet

From discussions with the 2-5 teachers and administrators at Lake Dallas High School in Texas, the author concluded that using the Internet is a necessary source for gathering information for both teachers and students. The teachers reinforced the idea that the Internet enhanced the development of a good research project. The school library was small and had limited resources, so the Internet was a great help in finding adequate, up-to-date resources for research projects. Since it is easy for teachers to check Internet sources, plagiarism is not as prevalent as when using only library resources.

The teachers at Lake Dallas High School believe that students have easy access to the Internet, either at school or at home. There are also research questions which cannot be answered using only textbooks. Interviews, observations, and real-life experiences enrich the quality of the research and help to personalize any student's project. Teachers noted that the Internet helped students in many subject areas by logging on to a chat room and e-mailing other people. We also discussed that organizational skills did not improve with Internet use, but these skills do not decrease in the research process either. The potential of communicating with people of diverse interests, backgrounds, and locations makes the Internet ideally suited as a research tool. They felt as long

as teachers and students understand the rules that control the Internet, they will be able to fly down the information superhighway with ease. Hopefully, when given this Internet resource pamphlet, administrators and teachers will have an easier time finding the needed resources to become successful in classrooms.

Administrators and teachers succeed when students take a real interest in learning and using the Internet to enhance interests. When administrators provide an Internet resource pamphlet which contains reliable Web sites for all disciplines, the teacher spends more time with students rather than searching for information on the Web. This pamphlet also provides an incentive to teachers to expand their lessons by using computer technology. This resource, in turn, can certainly aid both teachers and students in the future, by making them aware of the resources and information that are there for learning and expanding their potential.

paving the Way

Teacher's Internet Resource

Web Sites for All Subject Disciplines

Pamphlet Preface

The Internet, with all its freedom and awe, stretches out like an ever-changing wasteland of knowledge. Before people go on the technological adventure, they need a good guide. This Internet resource pamphlet is just that--a good guide, not only for administrators and educators, but also for parents.

If one spends any time online, he or she knows the Internet can be frustrating, time-consuming, and disturbing. The Internet, however, can also be fascinating, compelling, enlightening, and absorbing. Most importantly, the Internet is the single largest collection of cooperative learners in this world working together, sharing infinite stores of knowledge.

Teachers do not have time for the Internet to become a threat. A threat might mean a time-waster, in which lost minutes become lost hours, or a disturbing problem when one accidentally logs onto the wrong information. With a little knowledge and related applications, one can control students' and personal Internet experiences.

The teacher is in charge of explorations and discovery learning. One of the main considerations with Internet explorations is being able to decide, based on some type of applicable knowledge and information, where one is headed and why. Administrators can guide teachers toward the right path with the aid of

the Internet pamphlet. The hard part, finding reliable information, is done for the teacher and administrator. Now, they need only use it. The purpose of this pamphlet is to give enough information for teachers to make those decisions and incorporate the offerings of the Internet to classrooms quickly. For administrators, the purpose is to give teachers the incentive to expand their usual classroom activities by including computer technology without unnecessary stress. Administrators are the leaders of our schools and must exhibit the need to step into the future with technology as a partner.

AUTHORS

Angelou, Maya
www.geocities.com/Athens/1523/maya.html
Poetry, sound, pictures and other related features

http://homearts.com/depts/family/mayaf1.htm
Reading lists for children by Maya

Austen, Jane
www.pemberley.com/janeinfo/janeinfo.html
Texts to her six novels and literary criticisms

www.infoseek.com/Arts_and_Entertainment/Books/authors/Austen_Jane
List of books by Jane Austen

Baum, L. Frank
www.geocities.com/Hollywood/Hills/6396/index.html
Trivia, news, images, games, collectibles and almost any question about Oz

Carle, Eric
www.eric-carle.com
Biography of the author and lists of his books

Carroll, Lewis
www.lewiscarroll.org/carroll.html
Facts about Carroll, including pictures, graphics, popular culture, and contacts

www.users.interport.net/~fairrosa/carroll.html
Information about books and music created by Carroll

Cleary, Beverly
www.teleport.com/~krp/ClearyBio.html
Biography of Beverly Cleary

www.teleport.com/~krp/cleary.html
Beverly Cleary home page filled with information about her life

Doyle, Sir Arthur Conan
http://watserv1.uwaterloo.ca/~credmond/sh.html
Life and works of Sir Arthur Conan Doyle

King, Stephen
www.malakoff.com/skc.htm.
Interesting facts about King and a guide to some horror short stories

Lear, Edward
www.pair.com/mgraz/Lear/index.html
Biography, bibliography of his works, pictures, and interesting facts about Lear

www.castlemoyle.com/
Definition of the limerick, biography, and lessons plans

Nash, Ogden
www.mnsinc.com/wbarron/wb-nol.html
Poems and limericks by Nash

www.aimnet.com/~veeceet/kids/nash.html
Poems about animals by Nash

Seuss, Dr.
http://klinzhai.iuma.com/~drseuss/seuss
Biographical information and parodies of his works

Shakespeare, William
www.shakespeare.com/
Links to a poetry panel, Shakespeare queries and replies, Shakespearean history and other useful facts about Shakespeare

Wilder, Laura Ingalls
http://webpages.marshall.edu/~irby1/laura.htmlx
Life of Laura Ingalls Wilder as she really lived

FOREIGN LANGUAGE

www.csun.edu/~hcedu013/eslsp.html
Resources for French, Spanish, German, Latin, Chinese, Japanese, Armenian, Hebrew, Indonesian, Korean, Basque, Italian and other related resources

www.erols.com/jbrennan/flteachers.htm
Page after page of material collected by foreign language teachers

Chinese
www.deall.ohio-state.edu/chan.9/c-links.htm
Everything to help one learn or teach the Chinese language

www.webcom.com/~bamboo/chinese/chinese.html
Everything one needs to know to learn Chinese or learn about the Chinese

ESL
www.aitech.ac.jp/~iteslj/
Everything for ESL teachers is here with lessons plans, articles, projects and other features

www.pacificnet.net/~sperling/
Mailing lists, discussion groups, and great sites for listening, speaking, reading, writing, and vocabulary

French
www.sunsite.unc.edu/wm/paris/
The Louvre, French for travelers, and Le World-Wide Wed are accessed through the France Home Page along with a map of France and English directions

www.utm.edu/departments/french/french.html
Links to dictionaries, libraries, newspapers, museums, universities and other features

German
www.uncg.edu/~lixlpurc/german.html
Activities for students, chat rooms, language exercises of various levels and other features

www.aatg.org
On-line literary text data bases, dictionaries, teaching units, information about holidays and festivals and other links to occupy students for hours

Italian
www.june29.com/Italian/
Lessons for learning Italian

www.italyemb.nw.dc.us/italybbs/index.html
Resources for learning the Italian language, culture, and other features

Spanish
www.cortland.edu/www/flteach/usafa/taller.html
Lesson plans for the busy Spanish teacher

www.kn.pacbell.com/wired/Algunas/spanish.html
Links to magazines, newspapers, government resources, culture, several home pages, and other features

Vietnamese
www.ozemail.com.au/~mariavu/
Vietnamese interactive course

www.vietgate.net/
Fonts, recipes, software products, and other features

GEOGRAPHY

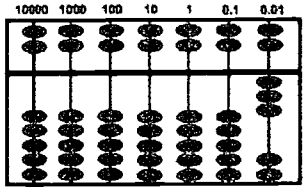
www.runet.edu/~geog-web/
Skills, definitions, national standards, and other useful features

www.aag.org/index.html
Facts about famous people with an interest in geography

MATH

www.mtjeff.com/~bodenst/math.html
ERIC math lesson plans with a section on water, matter, energy, atoms and molecules

www.csun.edu/~vceed009/math.html
Lesson plans, activities, applications, board games, puzzles, organizations and other features



The Abacus
www.ee.ryerson.ca:8080/~elf/abacus/
Instruction for both addition and subtraction and the option of using a virtual abacus as well as information about ordering a real abacus or building one out of Lego blocks

www.abacus-system.com
Overview of the history, use of the abacus, and directions for building one

Addition
www.wwinfo.com/edu/flash.html
Flashcard application that tracks the results

www.forum.swarthmore.edu/~steve/
Lesson plans for teaching addition

Algebra
www.math.unl.edu/~msapir/cgi-bin/
Complete online course

www.forum.swarthmore.edu/algebra/k12.algebra.html
Resources for the math teacher and students with graphing functions, problem-solving applications, online tutorials, and other features

Calculus
www.math.psu.edu/dna/graphics.html#differential
Various classic calculus diagrams that clarify the concepts that need visual reinforcement

www.hofstra.edu/~matscw/realworld.html
Everything you need for teaching Calculus

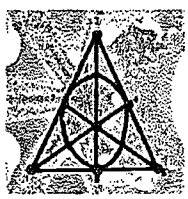
www.ma.iup.edu/projects/CalcDEMma/Summary.html
Options for more advanced classes are presented

Division
www.webmath.com/sn_divide.html
Division using Scientific notation

www.aplusmath.com/hh/division.html
Games, lesson plans, homework helper and other features

Fractions
www.lessonplanspage.com/Math.html
Lessons plans for all levels

http://forum.swarthmore.edu/paths/fractions/edible/fractions.html
Lessons plans that give practice to understanding fractions



Geometry
www.tqd.advanced.org/2647/geometry/geometry.htm
Basics in introduction to Geometry which include solving problems and checking the answers

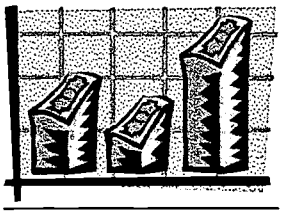
http://www.forum.swarthmore.edu/geometry
Lessons plans and course materials for teachers and students

www.geom.umn.edu/video
Computer animation, shapes, and other significant features

Graphs
http://www.teachnet.com
Simple line graph exercise to increase skills

www.cs.uidaho.edu/~casey931/mega-math/
Multi-purpose site for math students and teachers

History
www.sunsite.unc.edu/expo/vatican.exhibit/exhibit/d-mathematics/Mathematics.html
Everything on Greek mathematics, Ptolemy's geography, and Greek astronomy



Money
www.ex.ac.uk/~RDavies/arian/llyfr.html
Developments in the money system and origins of money and banking

www.ed.gov/pubs/parents/Math/index.html
Facts about math in the home and other features

Multiplication
http://zephyrpress.com/cgi-bin/zephyrcat/1085.html
Multiplication secrets, assessments, games, puzzles, and other useful features

www.its-a-living.com/wwwboard/messages/962.html
Free multiplication programs for all age levels which supplies the answers and helpful hints to solving

Patterns
www.learner.org/content/k12/acpbtv/mfa/patterns.html
Guide to math and science reform, science and mathematics initiative databases and various activities on patterns for all ages

http://sbgmath.com/gr6/610p405/610p405_ins0.html
Eight pattern activities that include triangles, polygons, and other related shapes

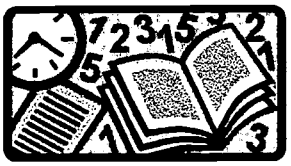
Subtraction
www.dpi.state.nc.us/Curriculum/Mathematics/Mth.LssnPlns/Mth.1.7.3
Strategies for instruction in simple subtraction

www.black-hole.com/users/rsch/subtips.html
Subtraction tips and tricks

Time
www.physics.nist.gov/
Evolution of time measurement with calendars, clocks, and other features

www.panix.com/~wlinden/calendar.shtml
Calendar and clock information

Trigonometry
http://forum.swarthmore.edu/dr.math/faq/formulas/faq.trig.html
Trigonometry formulas and other related features



SCIENCE

www.esu.edu/~bbq/ed_resources.html
Resources for secondary science teachers

Anthropology
www.nitehawk.com/alleycat/anth-faq.html
Anthropology resources and discussion groups

www.anth.ucsb.edu/
Anthropology projects, programs and other relevant features

Animals
www.mindspring.com/~zoonet/
Links to zoos by country, information about endangered animals, photo galleries, and other interesting features

http://netvet.wustl.edu/ssi.htm
Information on all animals and inclusive with related pictures

Archaeology
http://spirit.lib.uconn.edu/ArchNet/
Museums, questions and answers, and various subjects

www.interlog.com/~jabram/elise/archres.htm
Archaeology resources on various levels, virtual sites and other significant features

Astronomy
http://ast1.spa.umn.edu/Outreach/pub_out.html
Everything you ever wanted to know about Hale-Bopp comet, the Hubble Space Telescope images, the Aurora phenomenon, and other facts and pictures

http://seds.lpl.arizona.edu:80/billa/twn/
Night sky is enhanced to all its beauty

Birds
www.us.net/birds/hbfindex.html
High-speed photographs of a variety of birds

www.nceet.snre.umich.edu/Curriculum/toc/html
Lesson plans, facts, scientific terms, bibliography, lab experiments and other related features

Cartoons
www.cartoon-factory.com
Science of cartoon-making comes alive

www.cartoonexpress.com
Links to a variety of cartoon fun

Chemistry
www.shef.ac.uk/~chem/Web-elements/
Web site for the Department of Chemistry includes periodic table and other features

www.chem.rpi.edu
Chemistry facts and projects

Dinosaurs
www.hcc.hawaii.edu
Links to several dinosaur-related sites

http://pubs.usgs.gov/gip/dinosaurs
Questions and answers about dinosaurs and links to other related sites

Dolphins
www.whaleclub.com
Links to people protecting dolphins, whales, and manatees

www.tmmc.org/dolphins.htm
Facts about dolphins and porpoises

Earth Day
http://earthday.wilderness.org
News, commemorative stamps, Earth Day founder, environmental timeline, and other relevant information

www.halcyon.com/arborhts/earthday.html
Earth Day grocery project for all ages

Earthquakes
www.seismo.unr.edu/htdocs/info.html
Current information and links about earthquakes

Elephants
www.discovery.com/area/nature/elephants/0406.html
Field notebook on the African elephant and complete information on each species

www.sazoo-aq.org/indeleph.htm
Facts on the Asian elephant from birth to death

Fish
http://Netvet.wustl.edu/fish.htm
Electronic zoo includes interactive play for all ages

Geology
http://duke.usask.ca/~reeves/prog/geoe118/geoe118.011.html
Rock cycle explained, lesson plans and other features

http://nyelabs.kcts.org/
Rocks, soil, lab experiments, and other significant sites

www.lib.utexas.edu/Libs/GEO/geology.html
Facts and pictures about rocks and soil

Insects
www.nj.com/yucky
Vocabulary, facts, yucky bug jokes, and colorful pictures

www.eagle.ca/~matink/insects.html
Lesson plans, themes, links to resources, and other relevant features

Oceanography
www.esdim.noaa.gov/ocean_page.html
Oceanography resources and tours of aquariums

www.sasked.gov.sk.ca/docs/elemsci/gr2uiesc.html
Primary unit on the oceans that includes plant growth and habitat

Wombats
www.bekkoame.or.jp/~makino/wombat.htm
Pictures, facts, and other related links

SOCIAL STUDIES

http://education.indiana.edu/~socialst/
General history, government, politics, culture, world and United States history, and other useful features

African-American History
www.msstate.edu/Archives/History/USA/Afro-Amer/afro.html
Information on black history reported by region

Ancient Greece
www.perseus.tufts.edu/
Digital library of ancient world resources

www.greekcivil.ariadne-t.gr/default.html
Facts about Greek civilization and its downfall

Ancient Rome
http://eawc.evansville.edu/index.htm
Interesting facts and myths regarding Ancient World cultures

www.hyperhistory.com
Ancient Rome history chart, timeline map, testimonials of era, and other significant information

Civil War
http://rs6.loc.gov/cwphome.html
Civil War photographs

Current Events
www.motherjones.com/index.html
Up-to-date news with the liberal view of several contemporary editorialists

www.nationalreview.com/
Online version of *National Review*

Desert Storm
www.nd.edu/~aleyden/contents.html
Facts and figures about the Gulf War

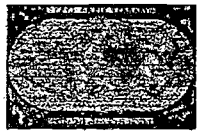
www.gulflink.osd.mil/
Narratives and illnesses reviewed and other related facts

Gold Rush
www.malakoff.com/postcards.htm
Gold rush postcards

Loch Ness Monster
www.glencass.demon.co.uk/index.html
History of the Loch Ness Monster with related pictures and sightings

www.scotnet.co.uk/highland/index.html
Pages of interesting facts about Nessie

www.lochness.co.uk/centre/index.html
Research and music on the Loch Ness Monster



Maps
http://icg.fas.harvard.edu/~maps/
Oldest and largest map collection in the United States

http://portico.bl.uk/index.html
Maps on the earth and the heavens

Prehistory
www.education-world.com/awards/past/r1296-09.shtml
Ceramic resources, flints and stones, exploring the world of prehistoric hunters, large prehistoric earthquakes, and other informative links

Space Program
www.ksc.nasa.gov/history/apollo/apollo.html
NASA Apollo Mission—Apollo 11

Revolutionary War
www.revwar.com
Revolutionary War re-enactors, battle sites, documents, news groups, and other relevant links

www.ccs.neu.edu/home/bcortez/revwar/revwar.html
Perspectives from both the American and British sides

United States History
http://rs6.loc.gov/ammem/amtitle.html
Photos, documents, motion pictures, sound recordings and other historical features

Vietnam War
http://grunt.space.swri.edu/index.htm
Accounts, both biographical and autobiographical, of participants and survivors

www.ionet.Net/~uheller/vnbktoc.html
Personal accounts of the Vietnam War

White House
www.whitehouse.gov/WH/kids/html/home.html
Socks, the first cat, tours the White House

World History
www.hartford-hwp.com/WHA/docs
Lesson plans on teaching world history

www.halcyon.com/FWDP/fwdp.html
Information on historical events from all eras and reflections on cultures working together to change the future

World War II
www.worldwar1.com/
Site of multimedia facts and information covering the entire war

www.mcs.com/~mikei/tgws/rel.htm
Journal of the Great War Society with several activities, articles, and pictures

World War III
www.grolier.com/wwii/
Biographical information of important WWII figures, various related links, video and audio movies, and other useful sites

January 19, 2000

Information and Technology
Syracuse University, ERIC Clearinghouse
621 Skytop Road, Suite 160
Syracuse, NY 13244-4100

Dear Acquisitions Coordinator:

Please consider our manuscript entitled, "How Computer Technology Expands Educational Options: A Rationale, Recommendations, and A Pamphlet For Administrators" for possible publication in your Clearinghouse. Hopefully this paper, based on contemporary technology literature, practical uses, and future directions for success will be of interest to administrators and educators who work to enhance learning in effective schools.

Thank you for your interest and acceptance of an October, 1999 manuscript as well as your encouragements for new submissions in technology. I am looking forward to future correspondence regarding this manuscript. If I can be of further assistance with related questions, please contact me at my university address or phone. Thank you.

Sincerely,

PJ Karr-Kidwell

PJ Karr-Kidwell, Ph.D.
Professor, Educational Leadership
Texas Woman's University
Box 425769
Denton, TX 76204-5769
(940) 898-2241

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: HOW COMPUTER TECHNOLOGY EXPANDS EDUCATIONAL OPTIONS: A RATIONALE, RECOMMENDATIONS, AND A PAMPHLET FOR ADMINISTRATORS

Author(s): Panette Kelch and RJ Karr-Kidwell (please use both authors - thanks)

Corporate Source: TEXAS WOMAN'S UNIVERSITY, DENTON, TX 76204

Publication Date: 1/24/2000 +

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1 ↑ ☑

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A ↑ ☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B ↑ ☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: RJ Karr-Kidwell (Panette Kelch)	Printed Name/Position/Title: RJ KARR-KIDWELL, Ph.D., Professor
Organization/Address: Texas Woman's University, Educ. Leadership Dept., Box 425769, Bell Ave, mail stop, Denton, TX 76204-5769	Telephone: (940) 898-2241 FAX: (940) 898-2224
	E-Mail Address: Date: 1/24/2000

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2nd Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com

EFF-088 (Rev. 9/97)